



## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

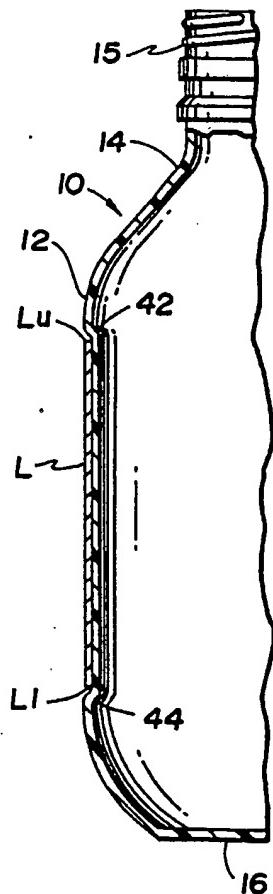
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(54) Title: PLASTIC CONTAINER WITH FLUID BARRIER LABEL

## (57) Abstract

A container (10) includes a label (L) on a side wall (12) which has abruptly curved portions (42, 44, 46) that provide a generally continuous outer surface at the junctions of the label edges with the side wall. The label (L) has different constructions for resisting the transmission of fluids through the container side wall and for providing a heat activated bond that secures the label to the container side wall during a blow molding process. Different plastics utilized to provide the barrier include polyvinylidene chloride, polypropylene, polyethylene, ethyl vinyl alcohol, acrylonitrile, and polyethylene terephthalate which may be used singly or with multiple types dispersed within each other or in separate layers. The labels (L) are disclosed as being made from paper strips and from the plastic that provides the barrier. The heat sensitive adhesive may be applied as a coating to the inner surface of the label, mixed with a plastic that provides the barrier, or provided by an inner surface of the barrier plastic. Best results are achieved when a pair of the labels are provided on oppositely facing sides of the container side wall so as to more fully cover the container and thus resist the transmission of fluids.



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PLASTIC CONTAINER WITH FLUID BARRIER LABEL

TECHNICAL FIELD

5 This invention relates to a container having improved resistance to the transmission of fluids such as liquids, vapors of the liquids, or other gases.

10

BACKGROUND ART

One problem with plastic containers designed to hold liquids is that the containers are permeable to certain liquids and to gas vapors of 15 the liquid, and other gases.

One specific example of the fluid transmission problem mentioned above involves plastic containers made from polyethylene terephthalate used 20 to hold carbonated beverages. Transmission of CO<sub>2</sub> through the polyethylene terephthalate containers results in a loss of the carbonization and thus limits the shelf life of the container. Another specific problem involves liquor containers made 25 from polyethylene terephthalate which is also permeable to H<sub>2</sub>O such that transmission of H<sub>2</sub>O of the liquor outwardly through the container reduces the volume of the container contents and simultaneously increases the proof level. Likewise, other 30 plastics which have good resistance to the transmission of certain fluids are permeable to other fluids. For example, the transmission of O<sub>2</sub> into a plastic container affects flavor, color, and bacteria growth of food contents.

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In order to overcome the fluid transmission problem mentioned above, one approach has been to coat the plastic container with a barrier material such as polyvinylidene chloride (PVDC).

5 Such a coating has previously been applied by a dip method to the exterior of the container; however, it has been found that this results in the fluid contents causing blistering of the coating and a consequent unsightly appearance as well as allowing  
10 the loss of some fluid contents. This outside coating also results in additional time and labor as well as problems involved with providing an even distribution of the coating.

15 In addition to the outside coating mentioned above, inside coating of the container with the barrier material has also been considered. However, such inside coating is difficult to perform and requires increased drying time.

20 Furthermore, the inside coating can result in flaking of the coating and consequent contamination of the container contents as well as requiring the additional time and labor involved with the exterior coating.

25

Plastic sleeves have also been used over plastic containers such as shown by United States Patents 4,183,441; 4,219,124; 4,315,573; and 4,342,399 to provide labelling, seam strengthening,  
30 upright support of an unstable container, strengthening, and the resistance of fluid transmission by the use of a metal foil of the sleeve. However, such sleeves due to the cost involved and other reasons have never found widespread acceptance.

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Plastic blow molding on a commercial level has recently incorporated the use of in-mold labelling to provide labelling of containers such as shown by United States Patents 3,108,850; 5 3,207,822; 3,292,209; 3,324,508; 3,608,020; 3,801,689; 3,986,807; 4,355,967; 4,359,314; 4,397,625; 4,479,770; 4,479,771; 4,479,644; 4,498,854; and 4,501,548. This in-mold labelling is performed by applying a label to the interior of 10 the mold prior to the plastic blow molding process. The resultant blow molded article is then blown around the label and advantageously eliminates the necessity for a post labelling operation as has been required in the past. However, such in-mold 15 labelling has not previously been capable of reducing the transmission of fluids through the container side wall.

DISCLOSURE OF INVENTION

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An object of the present invention is to provide an improved container for reducing the transmission of fluids through the container side wall. In carrying out this object, the container 25 is disclosed as being manufactured by an in-mold labelling operation during a plastic blow molding process so as to eliminate the necessity for any subsequent labelling after the blow molding and to also reduce the transmission of fluids through the 30 container.

A container constructed in accordance with the invention includes a side wall and an upper neck that extends upwardly from the side wall 35 as well as including a bottom that extends downwardly from the side wall to close the container.

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At least one label of a uniform thickness is provided on the side wall of the container and has an outer surface that faces outwardly as well as having an inner surface that faces inwardly toward  
5 the side wall. The label extends partially around the side wall and has side edges spaced from each other as well as having upper and lower edges respectively located below the neck and above the bottom of the container. The container side wall  
10 has abruptly curved portions adjacent the edges of the label to provide the container with a generally continuous outer surface at the junctions of the label edges with the side wall. A barrier of the label resists the transmission of fluids through  
15 the container side wall, and a heat sensitive adhesive secures the label to the container side wall.

As mentioned above, the container is  
20 disclosed as being made by an in-mold labelling process during a plastic blow molding operation. This blow molding process forms a parison around a label previously positioned within the mold to provide the abruptly curved portions at the label  
25 edges in order to thereby provide the generally continuous outer surface at the junctions of the resultant side wall with the label edges. During the blowing, the heat involved activates the adhesive to permanently secure the label to the  
30 container side wall such that the barrier is capable of continually resisting the transmission of fluids through the side wall.

In one version, the label is made as a  
35 paper strip having an inner surface facing inwardly toward the container side wall. In one embodiment,

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the barrier is provided as a coating on the inner surface of the paper strip and the heat sensitive adhesive is provided as a coating between the barrier coating and the container side wall. In 5 another embodiment of the paper strip label, the barrier is made of a plastic that resists the transmission of fluids and has an inner surface which functions as the heat sensitive adhesive that secures the label to the container side wall. The 10 paper strip label is also disclosed as having the barrier and heat sensitive adhesive being plastics of different compositions that are dispersed within each other as a coating on the inner surface of the paper strip. Each version of the paper strip label 15 is preferably disclosed as having an outer coating of lacquer for maintaining the label against marking.

The barrier of the container label is 20 most preferably provided by a plastic selected from the group consisting of polyvinylidene chloride, polypropylene, polyethylene, ethyl vinyl alcohol, acrylonitrile, or polyethylene terephthalate. A single type of one of these plastics may be used to 25 provide the barrier for resisting the transmission of fluids. However, when it is necessary to resist the transmission of different types of fluids through the container, more than one type of plastic may be used with each other in order to 30 resist the transmission of the fluids. This use of two or more plastics can be accomplished by dispersing plastics within each other as a single layer or by providing multiple layers of the different plastics depending upon the particular 35 container application and the plastics involved.

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In another version of the container, the label utilized is made from a plastic which defines the inner and outer surfaces of the label and functions as the barrier against the transmission 5 of fluids. Depending upon the fluids involved with the contents to be held by the container, the plastic providing the label in this version is selected from the group consisting of polyvinylidene chloride, polypropylene, polyethylene, 10 ethyl vinyl alcohol, acrylonitrile or polyethylene terephthalate. The heat sensitive adhesive is disclosed in one embodiment as being applied as a coating to the inner surface of the plastic label so as to adhere the label to the container side 15 wall. In another embodiment, the heat sensitive adhesive is dispersed within the plastic of the plastic label. It is also possible for the plastic that provides the label barrier to have an inner surface which functions as the heat sensitive 20 adhesive, which is one use for which polyvinylidene chloride is particularly suited.

The plastic label embodiment may be made from substantially only one type of plastic to 25 provide the barrier for resisting the transmission of fluids. Alternatively, the plastic label may be made from more than one type of plastic, either by a dispersion of the different types of plastic within each other or by separate layers of the 30 different plastics, to thereby provide the barrier for resisting transmission of different types of fluids through the label.

While a single label will decrease the 35 transmission of fluids through the container side wall, it is difficult to blow mold a container with

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a label on more than one-half on the container side wall, and a pair of labels are most preferably utilized located on oppositely facing sides of the container side wall to thereby provide increased 5 label coverage over the side wall and less unlabelled area through which transmission of fluids can take place.

The objects, features, and advantages of 10 the present invention are readily apparent from the following detailed description of the best modes for carrying out the invention when taken in connection with the accompanying drawings.

15

BRIEF DESCRIPTION OF DRAWINGS

Figure 1 is a sectional view through an open mold of a blow molding machine and is illustrated with a pair of labels being applied thereto 20 in preparation for a blow molding process that provides a container constructed in accordance with the present invention;

Figure 2 illustrates a parison that is 25 positioned between the mold sections of the labelled mold in the open position in preparation for the blow molding process;

Figure 3 illustrates the mold after 30 closure thereof and a partial blowing of the parison during the blow molding process;

Figure 4 illustrates the closed mold after completion of the blowing step of the blow 35 molding process;

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Figure 5 illustrates the mold after the blown container has cooled sufficiently to permit mold opening for ejection of the blow molded container;

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Figure 6 is an elevational view taken partially in section through the container of the invention;

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Figure 7 is a partial plan view taken in section through the container;

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Figure 8 is a sectional view through the container side wall and one embodiment of the label made from paper;

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Figure 9 is a sectional view through the container side wall and another embodiment of the label made from paper;

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Figure 10 is a sectional view through the container side wall and one embodiment of the label made from plastic; and

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Figure 11 is a sectional view through the container side wall and another embodiment of the label made from plastic.

BEST MODES FOR CARRYING OUT THE INVENTION

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With reference to the drawings, plastic blow molding apparatus illustrated in Figures 1 through 4 performs an in-mold labelling operation and is utilized to manufacture a labelled container 10 constructed in accordance with this invention as illustrated in Figures 5 through 7. This container

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10 includes labels L permanently adhered thereto to prevent the transmission of fluids through the container either inwardly or outwardly. Different types of plastic may be utilized to blow mold the  
5 container 10 as is hereinafter more fully described. Labels L of different constructions may be used to prevent the transmission of fluids in order to maintain the integrity of the contents after the initial filling of the container.

10

As illustrated in Figures 5 through 7, the container 10 has a side wall 12 that is illustrated as having a generally cylindrical shape in the disclosed embodiment. An upper neck 14 of the  
15 container extends upwardly from the side wall 12 to a spout 15 which is illustrated as being of the threaded closure type. A bottom 16 of the container extends downwardly from the side wall to close the container. As illustrated, a pair of the  
20 labels L are provided on the container side wall 12 between the upper neck 14 and the bottom 16. While it is preferable to utilize a pair of the labels in order to decrease the unlabelled area and the possibility of fluid transmission through the  
25 container, a single label will reduce the transmission of fluids and thereby provide the container with a greater shelf life than is otherwise possible.

30

With reference to Figure 2, the container is illustrated as being made from a heated plastic parison 20 that is illustrated as being of the injection preform type previously made by associated plastic injection molding equipment of the  
35 blow molding machine. However, it should be appreciated that the invention is also applicable

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to blow molding where the parison is made by extrusion or otherwise. The heated parison 20 illustrated is moved to the open mold 22 between the mold sections 24 and 26 in alignment with the 5 mold cavity sections 28. Vacuum passages 30 in the mold cavity sections 24 and 26 allow for securement of the labels L which are deposited in the cavity sections 28 by an initial labelling operation.

- 10 As illustrated in Figure 1, the labelling operation is performed by a label dispenser 32 that is movable along the direction of arrow 33 between a withdrawn position and an inserted position as illustrated with respect to the open mold 22.
- 15 Label carriers 34 are provided with vacuum passages extending to vacuum cups 36 utilized to secure the labels L. Retraction and extension of the label carriers 34 in a direction transverse to the direction of arrow 33 provides an initial transfer-  
20 ring of the labels from associated label magazines to the vacuum cups with the label dispenser 32 in the withdrawn position which is not illustrated. After the initial label securement, the label carriers 34 are retracted and the label dispenser  
25 32 is then moved to the inserted position where extension of the label carriers and termination of the vacuum drawn at vacuum cups 36 allows the vacuum drawn at the mold passages 30 to secure the labels in position. It is also possible to provide  
30 the vacuum cups 36 with a blast of positive pressure air that assists in releasing the labels. Retraction of the label carriers 34 and movement of the dispenser 32 to the withdrawn position in preparation for the next cycle is then followed by  
35 movement of the injection molded preform 20 to the

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position of Figure 2 as previously described in alignment with the mold cavity sections 28.

The blow molding process proceeds from 5 the Figure 2 stage to the stage shown in Figure 3 as the mold 22 is closed by movement of the mold sections 24 and 26 toward each other to enclose the parison 20 within the cavity 28. Pressurized gas is then blown into the interior of the parison 20 10 to stretch the molten plastic in both axial and circumferential directions. It is also possible to initially axially stretch the parison 20 by a push rod to provide increased biaxial orientation that enhances the strength of the resultant container. 15 The preform 20 thus moves downwardly and outwardly as illustrated to respectively provide the axial and circumferential stretching during the blow molding toward the final shape.

20 As illustrated in Figure 4, the blowing stage of the processing is completed when the resultant container 10 assumes the shape of the mold cavity 28 after having been blown around the labels L. The blown container is maintained within 25 the closed mold 22 for a sufficient period of time to permit cooling of the container in the designed shape.

As illustrated in Figure 5, opening of 30 mold 22 by movement of the mold sections 24 and 26 away from each other allows the blown container 10 to be ejected with the labels L secured thereto as is hereinafter more fully described. Thereafter, another pair of labels L are applied to the cavity 35 sections 28 of the mold in the manner previously described as the next cycle commences.

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As illustrated in Figures 5, 6, and 7, each label L extends partially around the side wall 12 of the blown container 10 and has side edges Ls spaced from each other in a circumferential direction. Each label L also has an upper edge Lu located below the neck 14 of the container and also has a lower edge Ll located above the bottom 16 of the container. The container side wall 12 as a result of the blowing process has abruptly curved portions 42, 44, and 46 respectively adjacent the upper, lower, and side edges of the label L to provide the container with a generally continuous outer surface at the junctions of the label edges with the side wall. As is hereinafter more fully described, the cross section of the label includes a barrier for resisting the transmission of fluids through the container side wall 12 and a heat sensitive adhesive that secures the label to the container side wall. The particular construction for providing the barrier and the adhesive will depend upon the particular application for which the container is to be used. However, regardless of the application, the reduction in the transmission of fluids through the container together with the continuous outer surface of the container side wall as a result of the abruptly curved portions 42, 44, and 46, and the economically manufacturing involved that eliminates subsequent labelling of the container provide an improved container over those previously available.

The construction of different embodiments of the label L is described below in connection with Figures 8 through 11. As described below, each label includes a barrier for resisting the transmission of fluids through the container side

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wall 12 and a heat sensitive adhesive that secures the label to the container side wall during the blow molding process.

5        As illustrated in Figure 8, one embodiment of the label L comprises a paper strip 48 having an inner surface including a barrier coating 50 for providing the barrier that resists the transmission of fluids through the container side  
10 wall 12. While different materials can be utilized to provide the barrier coating 50, polyvinylidene chloride (PVDC) works well to resist the transmission of CO<sub>2</sub> when the container 10 is made from polyethylene terephthalate and is designed to hold  
15 carbonated beverages. The heat sensitive adhesive is illustrated as being provided by a coating 52 that is a gel lacquer type heat seal which is sufficiently tacky to adhere the label to the container side wall 12 at about 70 degrees Centi-  
20 grade. The parison 20 illustrated in Figure 2 is heated to a sufficient temperature in the range of about 75 to 125 degrees Centigrade in order to have sufficient heat to activate the adhesive 52 so that the label becomes permanently adhered to the  
25 container side wall 12. An outer surface of the paper label strip 48 is preprinted and is then covered by an outer coating 54 of lacquer that prevents marking of the label and otherwise maintains the label appearance.

30        With reference to Figure 9, another embodiment of the label L is illustrated as being of the type with a paper strip 48 as previously described. This paper label L has a plastic  
35 coating 56 applied to the inner surface of the paper strip 48. The coating 56 after the

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completion of the blow molding operation is in direct engagement with the container side wall 12 and may be made in either of two different ways. Coating 56 in one version may be made from a 5 plastic, such as polyvinylidene chloride, which functions as the barrier for resisting the transmission of fluids and has an inner surface which functions as the heat sensitive adhesive for securing the label to the container side wall. 10 Likewise, other plastics that are resistant to the transmission of fluids and become tacky upon application of heat will also function in the dual role of providing the barrier and the heat sensitive adhesive for securing the label. In the other 15 version, the coating 56 is made from a barrier plastic that is dispersed throughout with a heat sensitive adhesive of a different composition. With both versions of the coating 56 on the inner surface of the label paper strip 48, the outer 20 surface of the paper strip 48 is provided with the lacquer coating 54 as previously described in connection with the embodiment of Figure 8.

With each of the embodiments of the paper 25 label L illustrated in Figures 8 and 9, the barrier is provided by a plastic whose composition for best results depends upon the fluid contents for which the container is designed to hold. This plastic is advantageously selected from the group consisting 30 of polyvinylidene chloride, polypropylene, polyethylene, ethyl vinyl alcohol, acrylonitrile or polyethylene terephthalate. Polyvinylidene chloride has been found to give very good results in resisting the transmission of  $H_2O$  and also functions well 35 in resisting the transmission of  $CO_2$  outwardly through container as well as preventing  $O_2$  from

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passing into the container. Polypropylene functions well in resisting the passage of  $H_2O$  and thus advantageously can be utilized to prevent  $H_2O$  from passing through plastic bottles made of polyethylene terephthalate to hold alcoholic beverages. While regular polypropylene functions well, it has been found that oriented polyethylene not only functions better but has better clarity if a transparent label is desired. Polyethylene will also prevent the transmission of  $H_2O$  but not quite as well as polypropylene. Ethyl vinyl alcohol resists the transmission of  $CO_2$  and  $O_2$  better than polyvinylidene chloride but has less resistance to the transmission of  $H_2O$ . Acrylonitrile also functions well in resisting the transmission of  $CO_2$  and  $O_2$  but does not function quite as well as polyvinylidene chloride in resisting the transmission of  $H_2O$ . Polyethylene terephthalate has resistance to the transmission of  $O_2$  but, as mentioned above, is not particularly resistant to the transmission of  $H_2O$  or  $CO_2$ .

With the paper strip type of labels L illustrated in Figures 8 and 9 as described above, a single type of plastic may be used to provide the barrier for resisting the transmission of fluids. It is also possible to use more than one type of plastic in order to provide the barrier for resisting the type of fluids if a single plastic will not provide resistance to all of the fluids necessary for any particular application.

With reference to Figures 10 and 11, two different embodiments are illustrated of the label L made from plastic which defines the inner and outer surfaces of the label and functions as the

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barrier against the transmission of fluids. With each of these embodiments as with the barriers of the previously described paper labels, the labels are made from a plastic selected from the group 5 consisting of polyvinylidene chloride, polypropylene, polyethylene, ethyl vinyl alcohol, acrylonitrile, or polyethylene terephthalate whose properties are each mentioned above in connection with the paper labels.

10

In the Figure 10 embodiment of the plastic label L, a heat sensitive adhesive coating 52 is applied to the inner surface of the plastic label. As with the paper label illustrated in 15 Figure 8, the coating 52 of heat sensitive adhesive may be provided by a gel lacquer although it is also possible to use other heat sensitive adhesives such as polyvinylidene chloride or any other heat sensitive adhesive that will function for the 20 particular application involved.

The plastic label L illustrated in Figure 11 has its inner surface directly engaged with the container side wall 12 and can be manufactured in 25 two different ways. In one version, the heat sensitive adhesive is dispersed within the barrier plastic of the label. In another version, the plastic that provides the barrier resistant to fluid transmission has an inner surface which 30 functions as the heat sensitive adhesive.

Each of the embodiments of the plastic label illustrated in Figures 10 and 11 may be made from substantially only one type of plastic to provide the barrier for resisting the transmission 35 of fluids. It is also possible for the plastic

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label to be made from more than one type of plastic to provide the barrier for resisting the transmission of fluids. When more than one type of plastic is utilized, the different types of plastics can be dispersed within each other or may be provided as separate layers.

It should be noted that certain types of plastic are not particularly adherent to each other. In such cases, the different layers of barrier plastic can be provided with an intermediate layer of a suitable adhesive film that bonds the barrier layers to each other.

With each of the embodiments illustrated in Figures 8, 9, 10, and 11, polyvinylidene chloride is one heat sensitive adhesive that can be used primarily as the barrier or as both the barrier for resisting the transmission of fluids and as the heat sensitive adhesive.

While the best modes for carrying out the invention have been described in detail, those familiar with the art to which this invention relates will recognize various alternative designs and embodiments for practicing the invention as defined by the following claims.

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WHAT IS CLAIMED IS:

1. A container comprising: a side wall; an upper neck that extends upwardly from the side  
5 wall; a bottom that extends downwardly from the side wall to close the container; a label of a uniform thickness on the side wall of the container; said label having an outer surface that faces outwardly and an inner surface that faces inwardly  
10 toward the side wall; said label extending partially around the side wall and having side edges spaced from each other; said label also having an upper edge located below the neck of the container and a lower edge located above the bottom of the  
15 container; said container side wall having abruptly curved portions adjacent the edges of the label to provide the container with a generally continuous outer surface at the junctions of the label edges with the side wall; said label including a barrier  
20 for resisting the transmission of fluids through the container side wall; and a heat sensitive adhesive that secures the label to the container side wall.
  
- 25 2. A container as in claim 1 wherein the label comprises a paper strip having an inner surface including a barrier coating for providing the barrier, and the heat sensitive adhesive being provided as a coating located between the barrier  
30 coating and the container side wall.
  
3. A container as in claim 1 wherein the label comprises a paper strip having an inner surface including a barrier coating for providing  
35 the barrier, and the barrier being made of a plastic that resists the transmission of fluids and

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has an inner surface that functions as the heat sensitive adhesive securing the label to the container side wall.

5           4. A container as in claim 1 wherein the label comprises a paper strip having an inner surface, and the barrier and heat sensitive adhesive being plastics of different compositions that are dispersed within each other as a coating on the  
10 inner surface of the paper strip.

5           5. A container as in claim 2, 3 or 4 wherein the paper strip label has an outer coating of lacquer.

15

6. A container as in claim 1, 2, 3 or 4 wherein the barrier is provided by a plastic selected from the group consisting of polyvinylidene chloride, polypropylene, polyethylene,  
20 ethyl vinyl alcohol, acrylonitrile or polyethylene terephthalate.

7. A container as in claim 6 wherein a single type of plastic is used to provide the  
25 barrier for resisting the transmission of fluids.

8. A container as in claim 6 wherein more than one type of plastic is used to provide the barrier for resisting the transmission of  
30 fluids.

9. A container as in claim 1 wherein the label is made from plastic which defines the inner and outer surfaces of the label and functions as  
35 the barrier against the transmission of fluids.

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10. A container as in claim 9 wherein the plastic label providing the barrier is made from a plastic selected from the group consisting of polyvinylidene chloride, polypropylene, poly-  
5 ethylene, ethyl vinyl alcohol, acrylonitrile or polyethylene terephthalate.

11. A container as in claim 10 wherein the heat sensitive adhesive is applied as a coating  
10 to the inner surface of the plastic label.

12. A container as in claim 10 wherein the heat sensitive adhesive is dispersed within the plastic of the plastic label.

15

13. A container as in claim 10 wherein the plastic that provides the barrier has an inner surface which functions as the heat sensitive adhesive.

20

14. A container as in claim 10 wherein the plastic label is made from substantially only one type of plastic to provide the barrier for  
25 resisting the transmission of fluids.

15. A container as in claim 10 wherein the plastic label is made from more than one type of plastic to provide the barrier for resisting the  
30 transmission of fluids.

16. A container as in claim 1 wherein the heat sensitive adhesive is polyvinylidene chloride.

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17. A container as in claim 1 which includes a pair of the labels located on oppositely facing sides of the container side wall.

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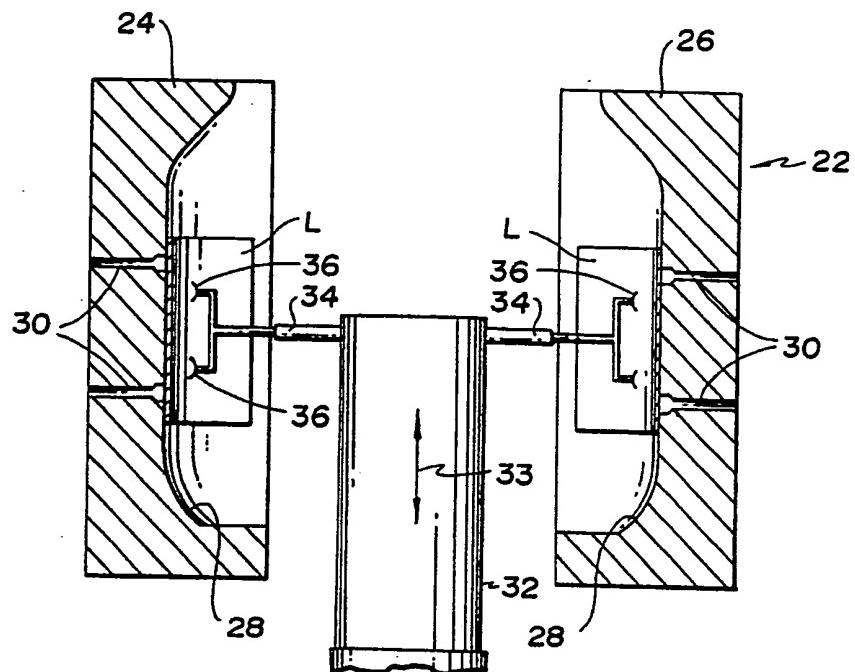


Fig. 1

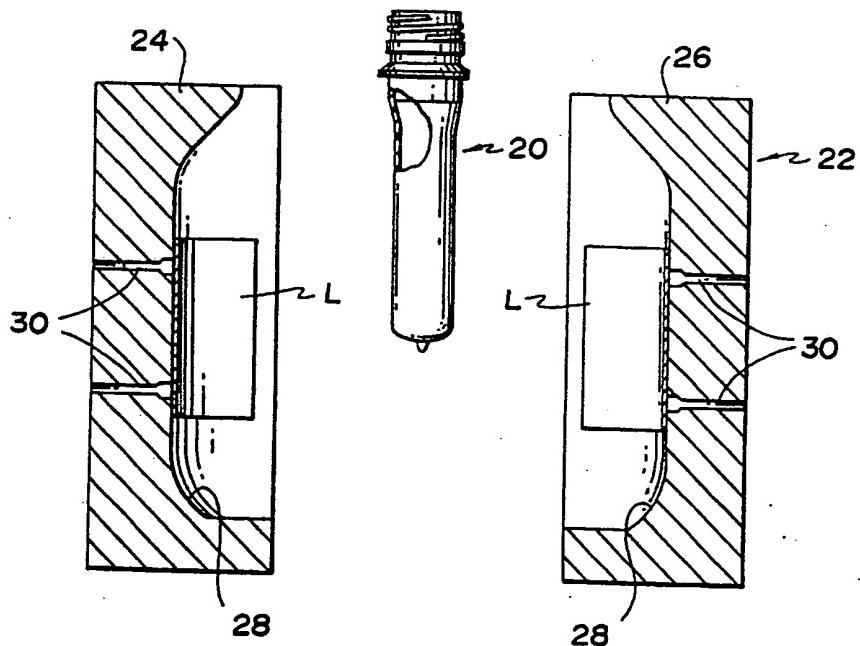


Fig. 2

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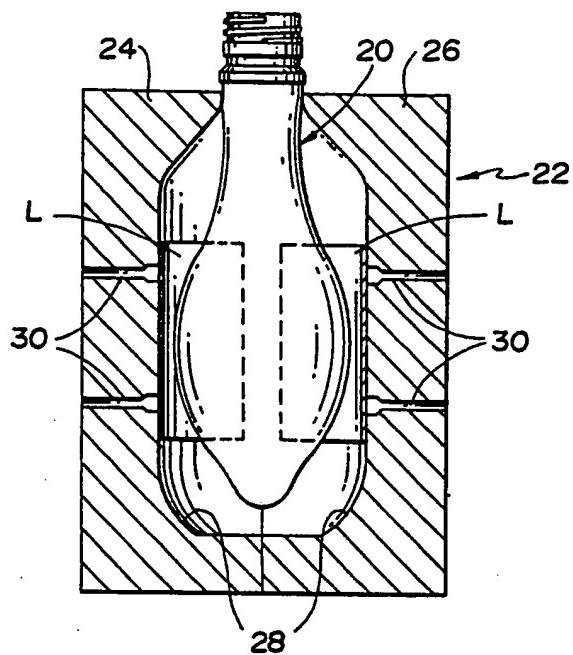


Fig. 3

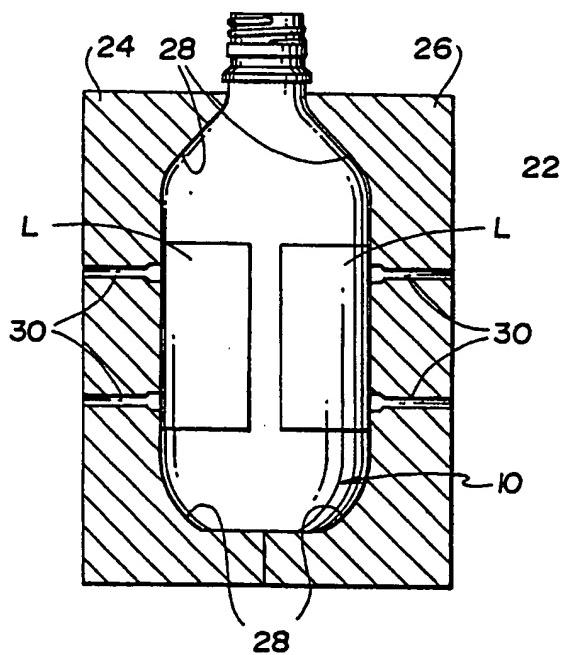
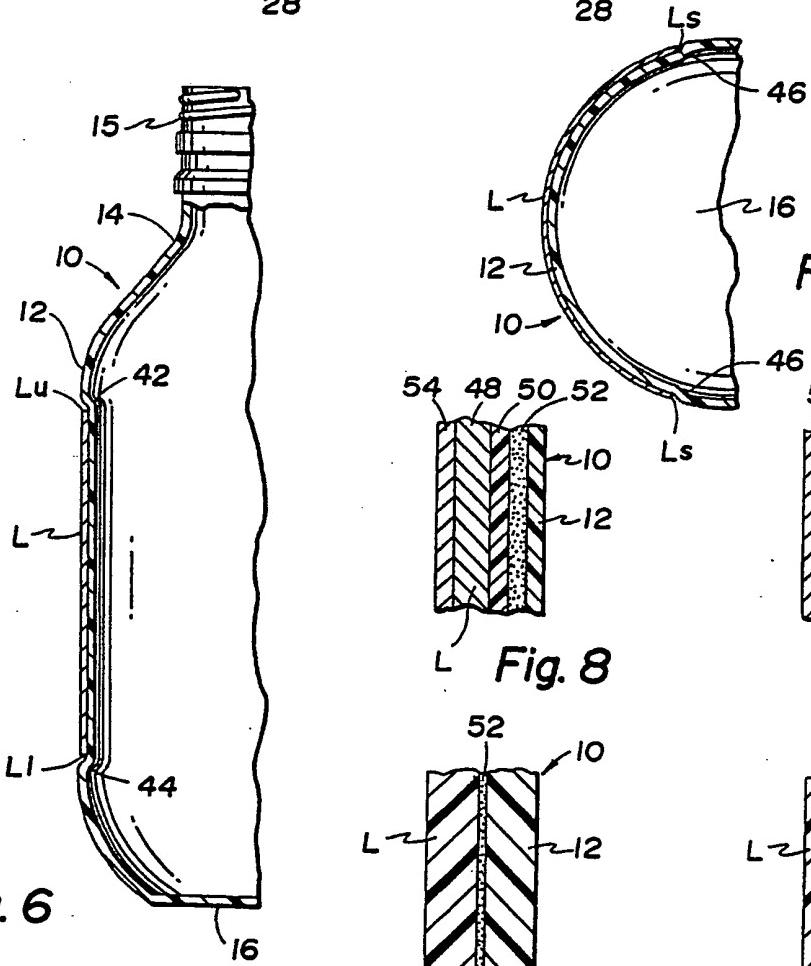
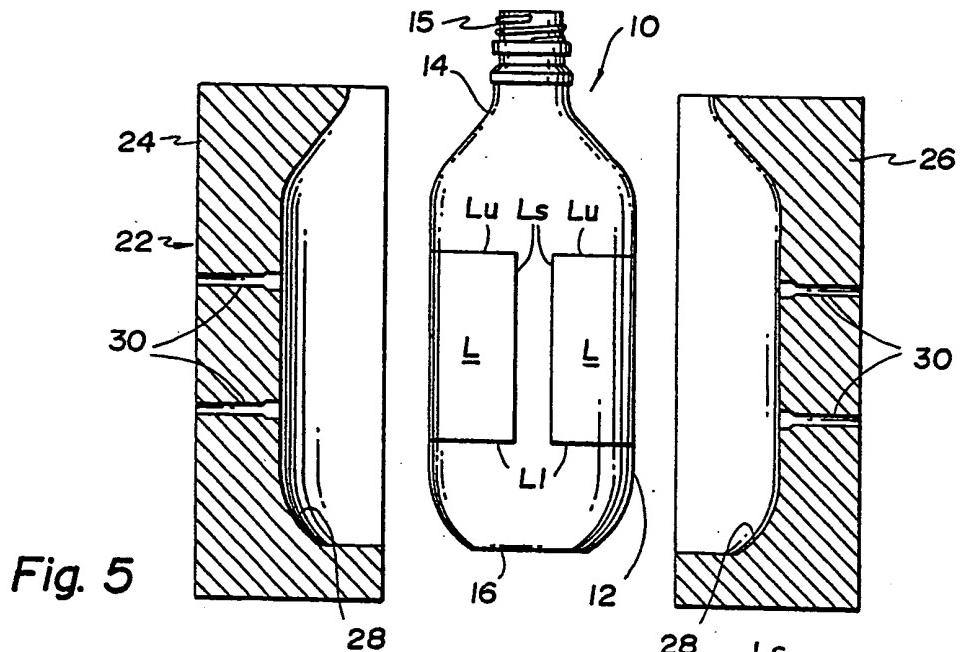


Fig. 4

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# INTERNATIONAL SEARCH REPORT

International Application No PCT/US86/00388

## I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all) \*

According to International Patent Classification (IPC) or to both National Classification and IPC

Int. Cl. 4 B65D 23/08

U.S. Cl. 215/12R; 40/310

## II. FIELDS SEARCHED

Minimum Documentation Searched \*

Classification System	Classification Symbols
U.S.	215/12R; 220/450; 40/310
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched *	

## III. DOCUMENTS CONSIDERED TO BE RELEVANT \*\*

Category *	Citation of Document, ** with indication, where appropriate, of the relevant passages ***	Relevant to Claim No. ****
A	US, A, 4,024,009, Published 17 May 1977 (Amsden et al)	-
A	US, A, 4,183,441, Published 15 January 1980 (Erlandson)	-
A	US, A, 4,210,259, Published 01 July 1980 (Schrecker)	-
A	US, A, 4,219,124, Published 26 August 1980 (Amberg)	-
A	US, A, 4,315,573, Published 16 February 1982 (Bradley et al)	-
A	US, A, 4,342,399, Published 03 August 1982 (Stirling)	-
A	US, A, 4,457,450, Published 03 July 1984 (Smith et al)	-
A	US, A, 4,567,681, Published 04 February 1986 (Eumei)	-

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"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

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## IV. CERTIFICATION

Date of the Actual Completion of the International Search :

14 April 1986

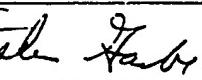
Date of Mailing of this International Search Report :

21 APR 1986

International Searching Authority :

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Signature of Authorized Officer \*\*

Stephen Garbe 

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